Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

THE PHYSIOLOGICAL ASPECT OF A SPECIES

DR. D. T. MACDOUGAL

CARNEGIE INSTITUTION OF WASHINGTON

THE simple recognition of different kinds of plants must be of great antiquity, and perhaps no single idea affords a better index of scientific thought during the last few centuries than the species conception. The occasion does not warrant a detailed statement of its development farther back than the time of Linnæus, who gave the idea a distinctly morphological stamp which it has retained to the present day. His systematization of natural objects marked the beginning of a period in which the morphological view of nature has prevailed throughout, the mechanics of form reaching its very apotheosis in the writing of De Candolle, De Bary, Hofmeister, Schwendener and a score of other eminent investigators who have triangulated the field of natural history of plants, basing relationships and constructing systems of phylogeny upon pure form, and upon the mechanical relations of cell-structure.

A century since, the ideas of continuing origination and endless evolutionary change took on definiteness and clearness with the writings of Lamarck, and this has grown until a distinctly vitalistic and genetic view-point has been gained, with the inevitable rearrangement of perspectives and modifications of conclusions as to the groupings and manner of relationships among living things.

Latterly, after statistical methods had reached a state of fair efficiency, their introduction into the study of occurrence, characters, distribution and form, has resulted in leading consideration from the type or the individual, to aggregates, or to the whole mass of individuals of a group, by which amplitude of variation and mode of ontogenetic procedure may be accurately outlined.

The development of this aspect of natural history has been followed by a truer estimation of capacities and activities as attributes of organisms, with the result that even morphology has come to be based upon physiological principles, upon which alone it may make further material progress.

The groups with which the physiologist deals in the detection of activities, estimations of functions and measurements of performance, consist of a series of generations of individuals through which identical qualities, characters and capacities are transmitted uniformly within the limits of fluctuating variability. These groups may sustain the most diverse relationship and all possible degrees of affinity, but differ essentially in their physiological response to any given environment under permanent existence in it.

To test such conceptions of hereditary entities implies pedigreed cultures, or observations upon lineal series under known conditions of descent, hybridization operations and statistical estimations. The various qualities do not display themselves equally throughout the metameres of the sporophyte, and it is by no means to be assumed that the flower, or the terminal portion of the shoot surviving at maturity, is a compendium of the various developmental stages. Nowhere is this more beautifully apparent than in intermediate hybrids of the first generation, in which the qualities of one parent predominate in the leaves and the other organs of the first, or lower internodes, while those displayed by the upper terminal portions of the stem and flowers may be those of the other parent. Exemplifications of this fact have also been observed, in which the internodes and the organs formed during the first season's growth in two nearly related forms were widely different, displaying divergent structures and different ''nasties'' and tropisms. During the second year's growth, the organs formed would be so nearly alike as to be in themselves inadequate for the separation of the two by ordinary taxonomic methods. These facts, which have been illustrated more than once in my own cultures, are quite at variance with the supposition that closely related forms are most alike in the seedling and younger stages and most divergent in the members of the adult formed latest.

Another form of transgressive variability is found when some descendants of individuals belonging to strain A, are apparently but little separated from B. Morphologically this would appear as an intergradation, but in reality the resembling individuals are divided and divisible into two groups, each carrying its own inherited potentialities, and in their progeny arranging themselves more or less symmetrically around the form of the strain, race or species. That the inclusion of the two is widely different may be illustrated in a striking manner by their action when crossed by a third form.

It can not be maintained that taxonomic thought has accurately or quickly reflected these modern estimations of the nature of living forms, for the very magnitude of the system necessary for the expression of relationships operates to prevent anything like a rapid or accurate adjustment.

Taxonomy is an eminently practical phase of botany, and it may reach its greatest general and total usefulness by confining its practise to the delineation of readily appreciable entities whether they be "natural" or "artificial."

So far as investigation in genetics and in the general functional activities of plants is concerned, however, progress is to be made only by increasing precision of measurement, and refined exactness of method of estimation of the qualities and characters concerned in the activities of the organism in both heredity and functional performance. The realization of this requirement comes but slowly. There are writers who still insist that the intricate pattern woven by the plant during its ontogeny, as determined by micrometric measurements, developmental observations, experimental tests and statistical estimations upon the aggregate of the group, shall be capable of demonstrations by the foot rule and hand lens applied to the apical structures exhibited by a single individual of the mature sporophyte, as if the pedometer and hand compass were adequate for testing the results of a triangulation made by the transit and steel tape. In other words, botanists of academic habit will with the greatest gravity attempt to read out of existence, and estimate of no importance, hereditary groups of organisms unless they conform to certain illy defined arbitrary standards.

Taxonomic thought rounds its broadest conceptions when its conclusions are based upon the aggregate of individuals within natural groups, and embody ontogenetic procedure, environmental relations, heredity, evolutionary change and comparative functional performance. So organized it might rightly lay claim to being "philosophical botany," and would include an orderly arrangement of all knowledge of plants, and would form the basis upon which all researches might be founded.

Taxonomic practise is quite another matter; hampered as it is by an outworn and mediæval method of giving names to living organisms, it is doubtful as to how far we might demand of it that it discriminate among the many degrees of relationship which reveal themselves in capacities and performance as well as in refinements of form. The more thoroughly and accurately however, that it takes into account the total sum of the attributes, qualities and capacities of the plant, the greater will be the value of its conclusions, and the greater will be the service it may render to coordinate branches of botanical science.